

## MALE PEDIPALPAL STRIDULATORY DEVICES IN NEOTROPICAL WOLF SPIDERS AND THEIR POSSIBLE ROLE IN SYSTEMATICS

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**ABSTRACT.** In males of several Uruguayan lycosid species of the genera *Lycosa*, *Schizocosa*, *Aglaoctenus* and *Allocosa*, we used Scanning Electron Microscopy to investigate the existence and the morphology of pedipalpal stridulatory-like structures. These kinds of structures only appeared in species belonging to the subfamily Lycosinae, and representatives of the Allocosinae and Sosippinae subfamilies lacked them altogether. Unlike European *Lycosa* species, all surveyed Uruguayan species of the genus *Lycosa* presented the character to some extent, but interspecific differences occurred in the relative size and development of the structure. *Lycosa thorelli*, *L. carbonelli* and *Lycosa* sp. showed a very well developed pedipalpal structure, which was smaller in *Lycosa polioostoma*. *Schizocosa malitiosa* also exhibited an only partially developed structure. A possible role of these pedipalpal stridulatory-like structures in lycosid systematics is discussed.

**RESUMEN.** Mediante Microscopía Electrónica de Barrido, hemos analizado la existencia y la morfología de las estructuras pedipalpales de tipo estridulador en los machos de varias especies uruguayas de la familia Lycosidae (géneros *Lycosa*, *Schizocosa*, *Aglaoctenus* y *Allocosa*). Este tipo de estructuras sólo está presente en especies pertenecientes a la subfamilia Lycosinae, mientras que las especies representativas de las subfamilias Allocosinae y Sosippinae carecen por completo de ellas. A diferencia de las especies europeas de *Lycosa*, todas las especies uruguayas del género analizadas presentan la estructura, aunque existen diferencias interespecíficas en su tamaño y desarrollo relativos. *Lycosa thorelli*, *L. carbonelli* y *L.* sp. presentan una estructura pedipalpal muy bien desarrollada, mientras que su tamaño es menor en *Lycosa polioostoma*. *Schizocosa malitiosa* también posee una estructura sólo parcialmente desarrollada. Discutimos una posible aplicación de estas estructuras en la sistemática de la familia Lycosidae.

**Keywords:** Lycosidae, *Lycosa*, *Schizocosa*, stridulation, Scanning Electron Microscopy

The impressive number of lycosid (Araneae, Lycosidae) species reported to drum with their pedipalps or their opisthosoma during courtship interactions led to an early interest in the role of stridulation in the production of courtship vibratory signals in this family (Kronestedt 1973; Rovner 1975). The first complete description of such a structure by Kronestedt (1973) found the scraper on the fourth coxae and trochanters, and the file on the surface of the book lung opercula (type g, Legendre 1963) in *Pardosa fulvipes* (Collett 1876). He used morphological data, and interpreted the function of this structure by considering its correlation with the abdominal movements produced by males during courtship.

Most other descriptions of lycosid stridulatory devices correspond to a different location (type h), first described by Rovner (1975), where the male pedipalp bears a file on the distal tibia, facing a single crest (scraper) on the proximal tarsus. It was originally described in several *Schizocosa* and *Lycosa* species, which were known to drum with their pedipalps during courtship interactions. Morphological similarities with other species led Rovner (1975) to suggest that it could be present in most, or all, species of both genera, including non-Nearctic ones.

Rovner's prediction was later verified for *Schizocosa* (Uetz & Stratton 1982, 1983) and expanded to include Palearctic *Hogna* (*H. radiata* (Latreille 1817), Fernández-Montraveta

et al. 2000). In fact, some of the Nearctic representatives of the genus *Lycosa* originally studied by Rovner (1975) were later transferred to this second genus (*L. aspersa* to *Hogna aspersa* (Hentz 1844), *L. carolinensis* to *H. carolinensis* (Walckenaer 1805), *L. helluo* to *H. helluo* (Walckenaer 1837)). Moreover, none of the *Lycosa* species studied by Rovner (1975) remain in the genus (*L. gulosa* is now *Gladicosa gulosa* (Walckenaer 1837), *L. punctulata* is now *Rabidosa punctulata* (Hentz 1844) and *L. rabida* is now *R. rabida* (Walckenaer 1837)). European representatives of the genus *Lycosa* surveyed until now (*L. tarentula fasciiventris* Dufour 1835 and *Lycosa* sp. (Parellada 1998)) lack such a structure (Fernández-Montraveta et al. 2000). Though transferred by Roewer (1955) to the genus *Allocosa*, *L. fasciiventris* Dufour 1835 is a burrowing species. It does not share any of the characters of the subfamily Allocosinae (Dondale 1986). On the contrary, it presents the typical characters of the subfamily Lycosinae and, particularly, of the genus *Lycosa* (Zyuzin & Logunov 2000).

Kronstedt (1996) described slightly different characteristics in the corresponding structure of male *Hygrolycosa* pedipalps. The main differences concerned the direction of the grooves in the file and the shape of the scraper. He interpreted these results by considering this pedipalpal structure as an apomorphy at some supraspecific level, the distribution of the character in the family reflecting a homoplasy. We have conducted a morphological study aimed at expanding information concerning the presence and the characteristics of these kinds of structures in several Uruguayan representatives of the genera *Schizocosa* (*S. malitiosa* (Tullgren 1905), and *Lycosa* (*L. poliostoma* (C. L. Koch 1847), *L. thorelli* (Keyserling 1877), *L. carbonelli* Costa & Capocasale 1984 and *Lycosa* sp. In order to better understand the distribution of the character in the family, we additionally investigated some Uruguayan representatives of other lycosid subfamilies (Dondale 1986), particularly *Allocosa brasiliensis* (Petrunkevitch 1910) (Allocosinae), and *Aglaoctenus lagotis* (Holmberg 1876) (Sosippinae).

## METHODS

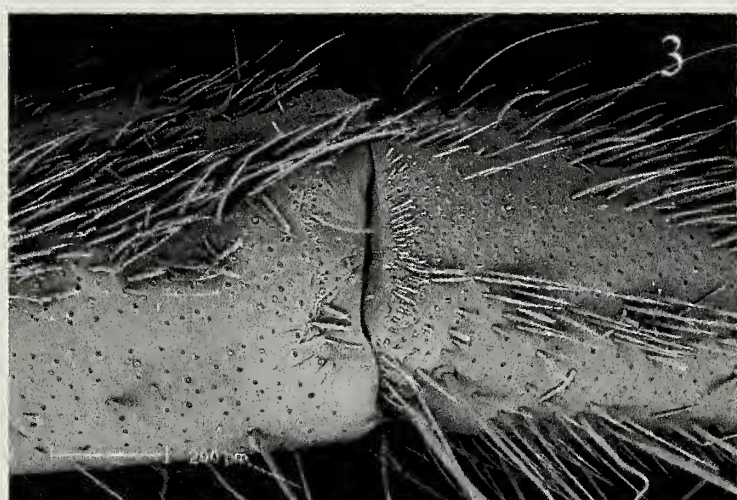
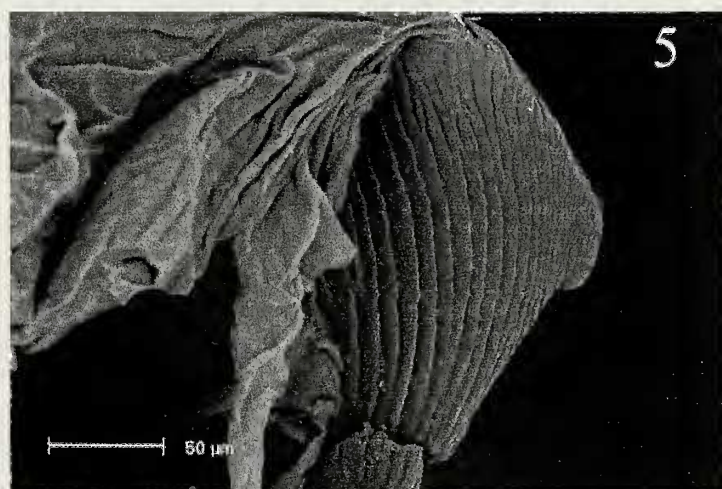
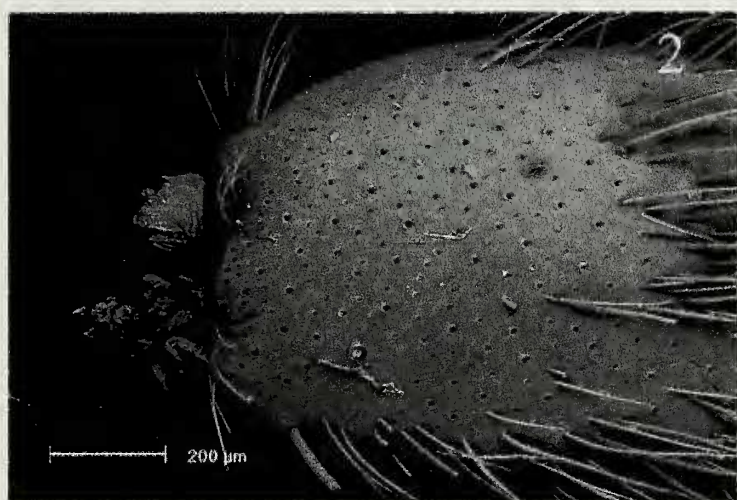
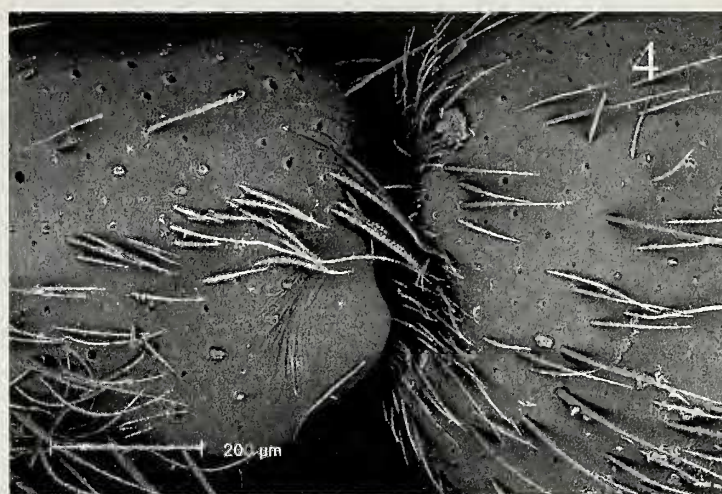
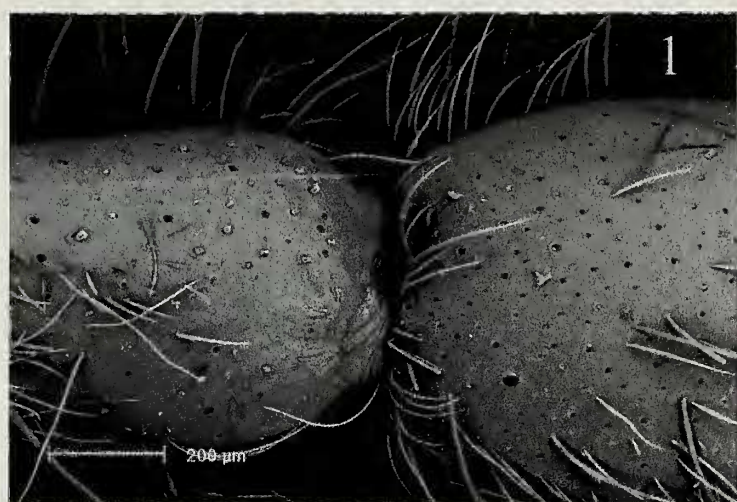
Material was prepared from adult males (one left pedipalp from two or three different

males for every species) collected in Uruguay, preserved in 70% ethanol and deposited at the collection of Sección de Entomología, Facultad de Ciencias, Montevideo. We dissected off the pedipalps and removed all hairs from the tibio-tarsal joint. One of the pedipalps was kept intact, while the tarsus of the other was separated from the tibia before dehydrating by standard procedure (ethanol series and acetone). After gold coating (BIO-RAD SC-502), samples were observed under SEM (Jeol JSM-5900LV, Servicio de Microscopía, Facultad de Ciencias, Uruguay; Philips XL30 Servicio Interdepartamental de Investigación, Universidad Autónoma de Madrid). The maximum length and width of the tibia and the tarsus was measured, together with those of the pedipalpal stridulatory-like structures. Relative sizes were calculated and compared between species.

## RESULTS

The morphology of the tibio-tarsal joint of the pedipalps of *Aglaoctenus lagotis* and *Allocosa brasiliensis* are presented in Figs. 1–3. No stridulatory-like pedipalpal structure is present in any case, as no protrusion of the tibial cuticle is observed (Figs. 1, 2), nor is there any proximal crest on the tarsus (Fig. 3).

On the contrary, all representatives of the Lycosinae showed some kind of pedipalpal stridulatory-like structures (Figs. 4–16). They were always located at the prolateral margin of the dorsal tibio-tarsal joint. *Lycosa thorelli*, *L. carbonelli* and *Lycosa* sp. (Figs. 4–10) showed a well developed structure highly similar to that described for most other lycosine genera: the file in the distal tibia possessed a series of parallel grooves and the single crest on the proximal tarsus (scraper) was extremely conspicuous. Slight interspecific differences were observed in the shape of the tibial protrusion, the density of grooves and the relative size of the tarsal crest. The tibial file of *L. thorelli* occupied about two thirds of the distal tibia (Fig. 4), showed a rather limited number of corrugations (Fig. 5) and faced a scraper corresponding to 50% of the proximal tarsus width (Fig. 6). The file edge was indented, as compared to the corresponding structure in *L. carbonelli*, which was slightly higher and showed a different pattern of parallel corrugations (Figs. 7–9). Indentation also appeared in the tibial protrusion of *Lycosa* sp. (Fig. 10),



Figures 1–3.—*Aglaoctenus lagotis* (1, 2) and *Allocosa brasiliensis* (3) male left pedipalps. 1. Tibio-tarsal joint, dorsal view; tibia appears at the left; 2. Proximal part of tarsus, dorsal view; 3. Tibio-tarsal joint, dorsal view.

Figures 4–6.—*Lycosa thorelli* male left pedipalp. 4. Tibio-tarsal joint, dorsal view; tibia appears at the left; 5. Inner surface, ventral view, of the tibial protrusion, showing a set of parallel corrugations and an indented edge; 6. Proximal tarsus, dorsal view, showing the conspicuous crest (scraper) facing the tibial file.

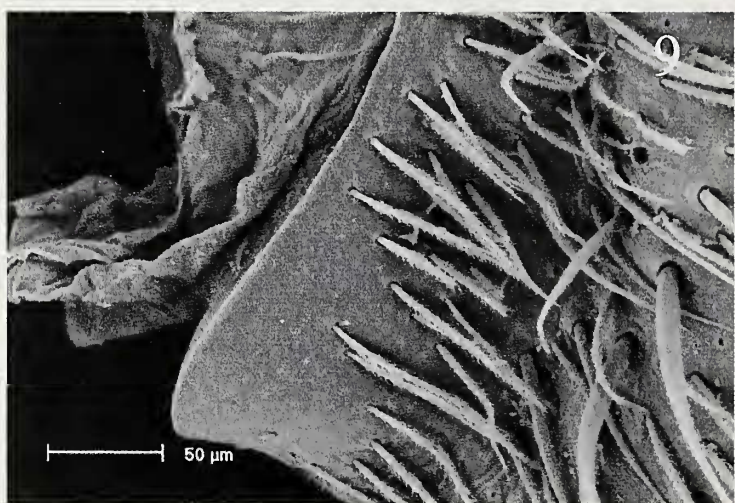
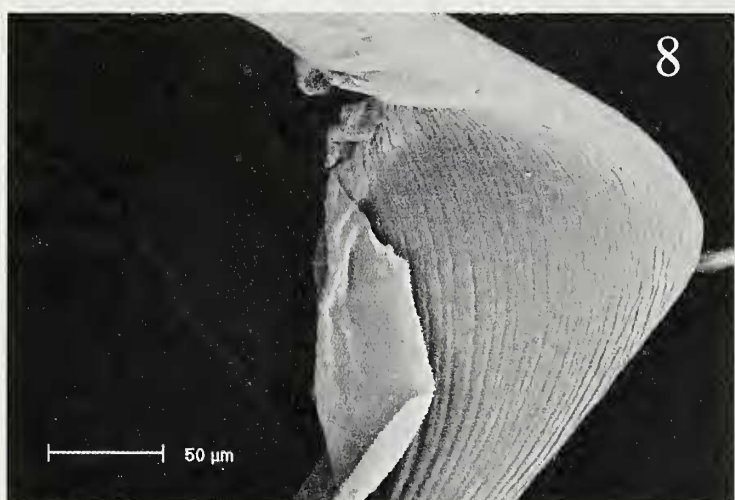
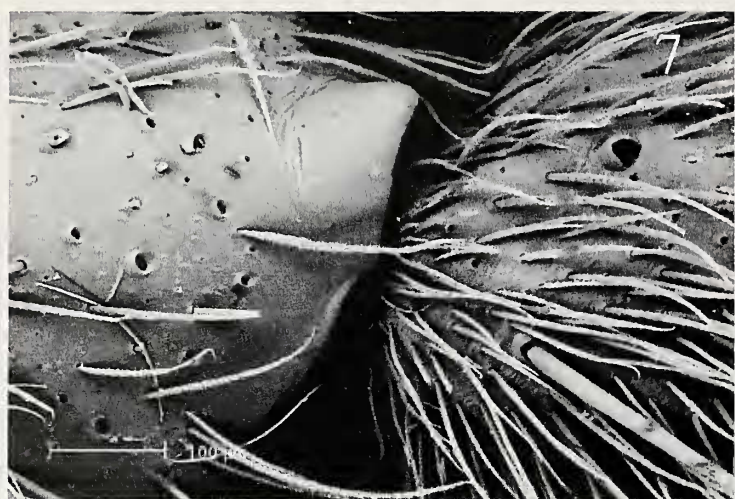
which was similar in size to the structure in *L. thorelli*.

The stridulatory-like structure found in *Lycosa poliostruma* (Figs. 11–13) was only about one third the relative size of those found in the other three species of the genus. The inner surface of the distal tibia possessed a smaller number of corrugations (Fig. 12) and the mobility of the joint was reduced. The tarsal crest was also much less conspicuous (Fig. 13), about half the relative size of those found

in the other three *Lycosa* species. A similar development of the structure appears in the representative of the genus *Schizocosa* (*S. malitiosa*, Figs. 14–16), with a smaller tibial protrusion and tarsal crest.

#### DISCUSSION

The morphology of the male pedipalpal tibio-tarsal joint in some Uruguayan lycosid species surveyed here only partially corre-



Figures 7–9.—*Lycosa carbonelli* male left pedipalp. 7. Tibio-tarsal joint, dorsal view; 8. Detail of the inner surface of the tibial protrusion, ventral view; 9. Proximal tarsus (dorsal view), showing the conspicuous crest (scraper) facing the tibial file.

sponds with previously published results. In contrast to some Palearctic species (Fernández-Montraveta et al. 2000), some of the Uruguayan species currently included in the genus *Lycosa* (*L. carbonelli*, *L. thorelli* and *Lycosa* sp.) possess a very well developed stridulatory-like structure. Though comparative data concerning relative sizes are unavailable, these structures strongly resemble those found in most *Hogna*, *Schizocosa*, *Gladicosa* and *Rabidosa* species (Rovner 1975; Stratton &

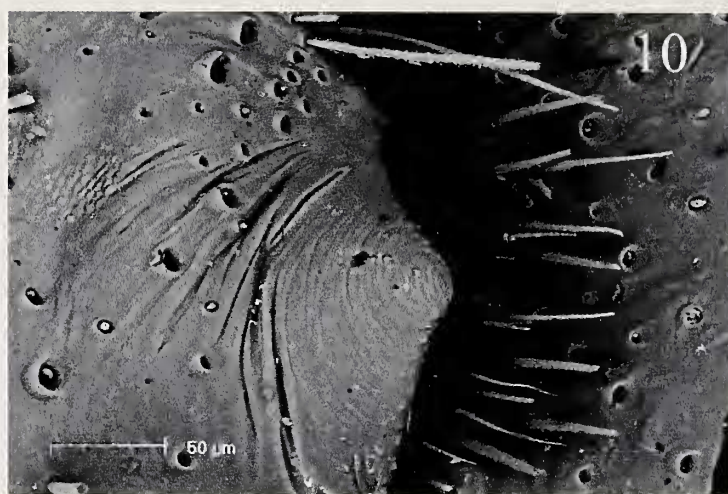
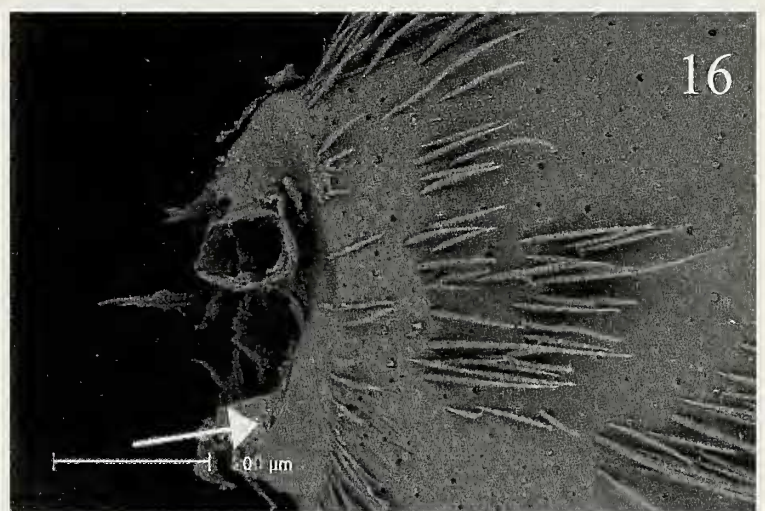
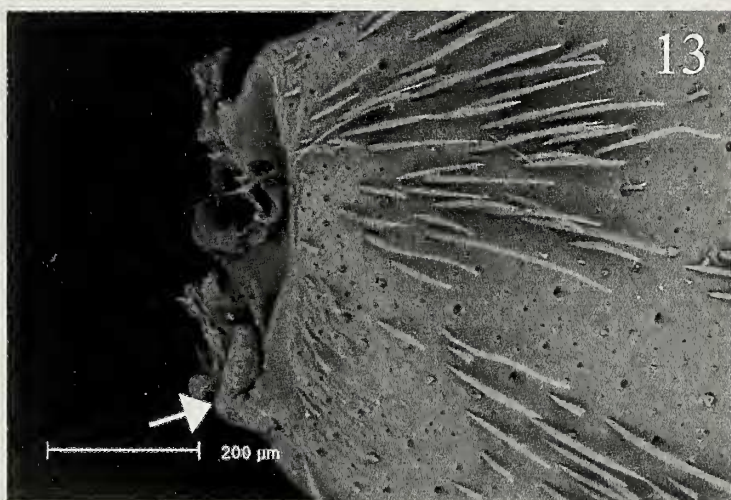
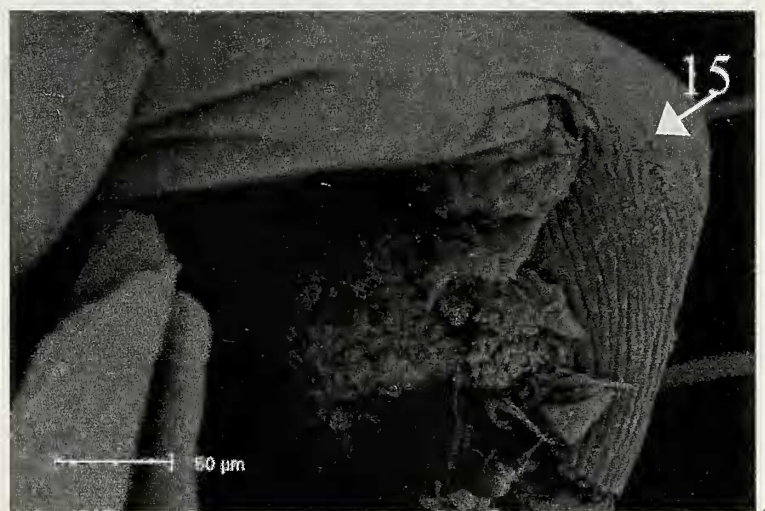
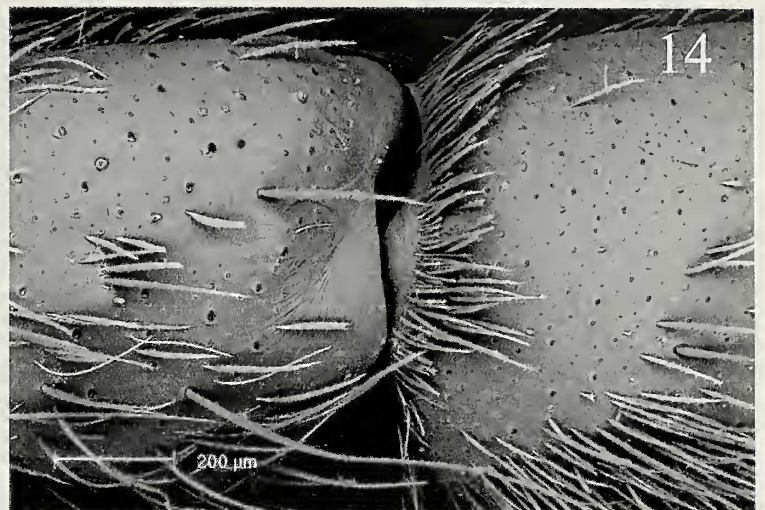
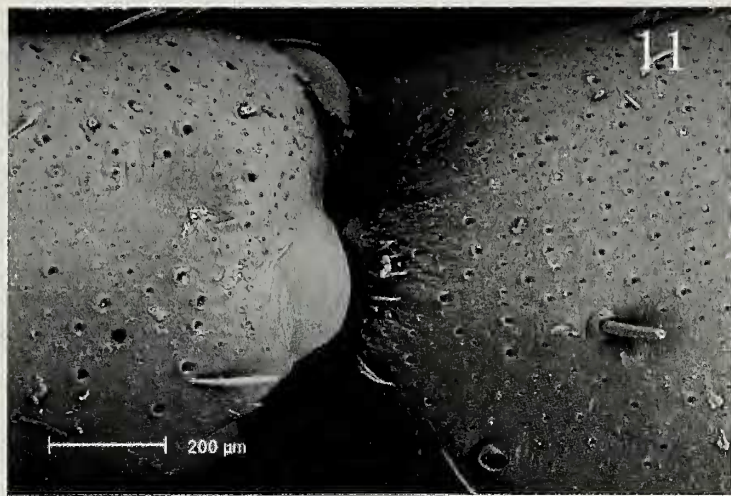


Figure 10.—*Lycosa* sp. male left pedipalp at the tibio-tarsal joint, dorsal view.

Uetz 1983; Fernández-Montraveta et al. 2000). The other Uruguayan representative of the genus *Lycosa* (*L. poliostoma*) presented a less developed structure, and was similar in this sense to the only representative of the genus *Schizocosa* (*S. malitiosa*) here studied.

This apparent inconsistency might agree with Rovner's (1975) and Kronestedt's (1996) expectations concerning the apomorphic nature of the stridulatory-like structures at a supraspecific level. First, we found no stridulatory-like structure in any of the representatives of two other lycosid subfamilies (Allocosinae and Sosippinae), nor has it ever been described in any other spider family. Second, all surveyed representatives of the Lycosinae possessed the character to some extent, and every time it was found, its position and general appearance were highly invariable. These two criteria (position and similarity) are widely accepted as useful in identifying morphological homologies in spiders (Sierwald 1989). Consequently, we hypothesize that the pedipalpal structures found in some Lycosinae are apomorphies at a suprageneric level.

This character may help solve some taxonomic problems within the Uruguayan Lycosinae, as previously stated for some Iberian species (Fernández-Montraveta et al. 2000). Thus, given the similarities in the morphology of the pedipalpal stridulatory-like structures, we hypothesize that neither *L. thorelli*, nor *L. carbonelli* nor *Lycosa* sp. should be classified as South American representatives of the genus *Lycosa*. In fact, there are some other morphological data, concerning male and female genitalia, which might support this proposal (pers. obs.).



Figures 11–13.—*Lycosa poliostruma* male left pedipalp. 11. Tibio-tarsal joint, dorsal view; 12. Inner surface of the tibial protrusion, ventral view, showing a set of parallel corrugations (arrow); 13. Proximal tarsus, dorsal view, showing the crest (arrow) facing the tibial file.

Figures 14–16.—*Schizocosa malitiosa* male left pedipalp. 14. Tibio-tarsal joint, dorsal view; 15. Inner surface, ventral view, of the tibial protrusion (arrow) showing the series of parallel corrugations; 16. Proximal tarsus, dorsal view, showing the less conspicuous crest (scraper, arrow) facing the tibial file.

As for *Schizocosa malitiosa*, the stridulatory-like apparatus is less developed than those described for other *Schizocosa* species (Rovner 1975). Moreover, it is highly similar to that found in *Lycosa poliostruma*. Interspecific similarities in other morphological (e.g. genital) characters should be analyzed in order to assess the taxonomic status of these two species. Actually, both the presence of the stridulatory-like structure and some genital

features could also question the placement of *L. poliostruma* in the genus *Lycosa*.

Besides basic similarity in placement and morphology of the stridulatory-like structures, our results also indicated slight interspecific differences. More remarkable differences occurred between the closely related species *L. thorelli*, *L. carbonelli* and *Lycosa* sp. *Lycosa thorelli* and *L. carbonelli* were originally de-

scribed as ethospecies (Costa & Capocasale 1984), given the lack of morphological differences between them. Our results might thus indicate a probable role of stridulation in the ethological isolation of these two closely related species (Stratton & Uetz 1983).

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